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Using a Design Science Perspective to Understand a Complex Design-Based Research Process

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ABSTRACT

The purpose of the paper is to demonstrate how a design science perspective can be used to describe and understand a set of related design-based research processes. We describe and analyze a case study in a manner that is inspired by design science. The case study involves the design of modeling tools and the redesign of an information service in a library. We use a set of guidelines from a design science perspective to organize the description and analysis of the case study. By doing this we demonstrate the usefulness of design science as an analytical tool for understanding related design-based research processes. And we argue that a design science perspective may be useful for both researchers and practitioners.

Keywords

Design science. Service design. Tool design. Complex design-based research process.

INTRODUCTION

In this paper we present the results of an analysis of a set of related design-based research processes. The common theme of the research processes is design and we use a design science perspective as the basis of the analysis. The involved design processes are about service design and design of tools for service design. At the center of the analyzed processes is a service innovation project. The purpose of this project was to redesign an information service in a library. The project involved experiments with modeling techniques and experiences from the project inspired design and redesign of modeling techniques.

Our analysis is based on the following related design-based research processes. (1) Design of a modeling technique called activity cases. (2) Design of a modeling technique called interaction primitives. (3) A service innovation project. (4) Improvement of interaction primitives. (5) Design of a modeling technique called service scenarios. We use these related processes as our empirical data. They constitute the basis of a design-oriented case study.

In order to use a design science perspective to describe and analyze these processes we have used the following seven guidelines (Hevner, March et al. 2004). 1. Design must be viewed as an artifact. 2. The problem that is partially solved by means of the artifact must be relevant in a specific context. 3. The designed artifact must be evaluated. 4. There must be one or more research contributions. 5. The research must be performed in a rigorous manner. 6. The design must be a search process (the solution must not be obvious). 7. The research results must be communicated.

We use these design science guidelines to analyze the five design-based research processes. Our overall research question can be formulated as follows: What happens if we use a design science perspective to describe and analyze a set of related design-based research processes? Consequently, the major purpose of the paper is to examine and evaluate the potentials of a design science perspective for researchers and for service designers.

Our findings can be summarized as follows. We demonstrate the usefulness of design science as an analytical tool for understanding related design-based research processes. We do this by using a design science perspective to create a coherent description of five related design-based research processes. Our description of the research processes clearly indicates that design science represents a useful perspective on research processes that use design as a fundamental part of the research method. We argue that a design science perspective may be useful for service designers. We do this by modifying the design science guidelines from a focus on research to a focus on learning. Furthermore, based on lessons from the innovation project we provide methodological advice for service designers.

The paper is organized as follows. First, we discuss the notion of a service in order to lay a conceptual foundation of one of the major themes of the paper. Next, we describe five design-based research processes. Then, we introduce the notion of design science and use it to analyze thes research processes. Finally, we discuss our results, we conclude the paper, and we suggest directions for further research.

SERVICE

The notion of a service is a business concept that focuses on value creation. Service-orientation represents an organizing principle in which everything that is offered by a business is thought of as a service. The inherent perspective of service-orientation is that a process is viewed as a set of services that is offered to consumers that interact with the providers of the services. Each service provider may itself be the consumer of other services. Thus, a process is viewed as a network of interacting providers and consumers. Businesses engage in such networks of services.

According to Hill a service is a "… change in the condition of a person, or a good belonging to some economic entity, brought about as the result of the activity of some other economic entity, with the approval of the first person or economic entity." (Hill 1977). This implies that the essence of a service is work activities that are performed in order to change the state of something for the benefit of someone.

Sheth and Verna view a service as a provider-consumer interaction that creates and captures value (Sheth, Verna et al. 2006). An organization can offer services using assets comprised of humans and software that interact with service consumers. This implies that a service is executed by a combination of human beings and IT systems in interaction with consumers.

Maglio and Spohrer view service as the application of competences for the benefit of another (Maglio and Spohrer 2008). Service science is the study of service systems, which are dynamic value co-creation configurations of resources, i.e., people, technology, organizations, and shared information. This implies that the consumer does much more than merely receiving the result of a service in a passive manner. The consumer's actions contribute to the value-creation in a significant and active manner.

The service-dominant logic supports this view with the assumption that the ability to act is a more fundamental resource than the resources that are transformed into physical products (Vargo and Lusch 2004; Arnould 2008; Madhavaram and Hunt 2008). The ability to produce an effect, i.e. to change the state of something, is more important than the resouces that constitute that which is changed. This implies that service are inherently perishable and intangible (Sampson and Froehle 2006). Service science is a research field that focuses on the essential characteristics of services (Chesbrough and Spohrer 2006; Paulson 2006; Spohrer and Riecken 2006; Lusch, Vargo et al. 2008).

DESCRIPTION OF RESEARCH PROCESSES

In this section we describe the five design-based research processes that constitute the paper's case study. In the following section we use a design science perspective to analyze the five processes.

Process 1: Design of a modeling technique called activity cases.

Process 2: Design of a modeling technique called interaction primitives.

Process 3: An innovation project aimed at redesign of a library service. During the project activity cases and informal versions of the interaction primitives were used to support service modeling.

Proces 4: Improvement of the modeling techniques called interaction primitives. The improvement was partially based on experiences from the innovation project.

Process 5: Design of a modeling technique called service scenarios. The design was based on experiences from the innovation project.

In the following sections we discuss the five processes in more detail.

Process 1 - Design of activity cases

An activity case represents an activity in terms of its name, intention, content, and environment (Bækgaard 2005). We designed the notion of activity cases in order to overcome some of the shortcomings of use cases (Cockburn 2001). A use cases can be used to represent a function of a system. A use case defines the function itself and the interaction between the function and actors in its environment.

For example, an ATM (automated teller machine) may defined in terms of functions like "withdraw amount" and "display account status". Each function can be defined by a use case that defines what goes on one inside the ATM when the function is executed. And it defines the corresponding interactions with a user of the ATM. User activities are not modeled unless they are interactions between the user and the ATM.

In some cases it suffices to focus on actions inside functions and on interactions. However, in other situations actors carry out important non-interactive actions outside use case functions. In such situations activity cases can be used. The content of an activity can include any relevant actions inside and outside use case functions.

We designed the notion of activity cases independently of the innovation project. We created specific activity cases during the innovation project and these were evaluated by the project manager.

Process 2 - Design of interaction primitives

We designed the notion of interaction primitives in order to offer a modeling supplement to flow-oriented approaches to process modeling (Bækgaard 2006). We designed four types of interaction primitives called Sense (an actor senses aspects of something), Move (an actor moves something), Control (an actor controls the behavior of another actor), and Modify (an actor modifies something).

We designed the notion of interaction primitives independently of the innovation project. We used interaction-based modeling during the innovation project (process 3) and the usefulness hereof were evaluated by the project manager. We discuss the notion of interaction primitives in more detail below (process 4).

Process 3 - A service innovation project

We participated in and studied an innovation project that was performed at a Danish public library. The innovation project were initiated by a librarian that wanted to improve the IT support for a service called "book a librarian". The librarian acted as a project manager.

The research process was performed as a collaboration between a researcher and the project manager. The researcher worked as a consultant that gave advice to the project manager. And the researcher participated directly in analysis of work activities and in the design of the improved service.

The researcher studied the innovation project and collected information about its progress and the artifacts that were created. The researcher used note taking and diary writing to capture relevant information about the project. The researcher interviewed the project manager in order to obtain insight into parts of the project in which the researcher did not participate.

During the project a number of analysis and design activities were carried out. User simulations were used to improve the understanding of the current version of the service. During these simulations two librarian's simulated the information search activities by playing the roles of library user and librarian. Modeling of as-is activities were used to capture aspects of the created understandings.

Formulation of future stories and brain storms were used to create visions about changed activities and new ways of using IT systems to improve the service. Modeling of to-be situations were used to capture aspects of the visions. Activity cases (Bækgaard, Jørgensen et al. 2007) and interaction primitives (Bækgaard 2006) were used to support modeling of alternative versions of the improved service.

The technical implementation of a new IT tool called a resource manager was carried out partially by external consultants and partially by the project manager and some of his colleagues. The primary purpose of the resource manager is to streamline the administration of selected information resources during "book a librarian" sessions.

The project manager arranged a sequence of meetings at various libraries in order to present and demonstrate the resource manager and its potential use in the "book a librarian" service. The meetings served as learning and feedback sessions in which other librarians learned about the resource manager and its use and in which the project manager obtained important feedback about potential improvements of the tool. The project manager created an installation package that made is easy for other librarians to install and use the resource manager.

The purpose of the "book a librarian" service is to support a library user's search for relevant information about a particular subject. The service is based on communicative interaction between a library user and a librarian that engage in a dialogue. The library user expresses information needs and the librarian asks questions and suggests interpretations in order to build a rich understanding of the user's needs.

The librarian uses his understanding of the information needs and his experience with information search to send search terms and parameters to search systems like library databases and Internet-based search engines. The library user and the librarian co-evaluates the search results and looks for potential relevant information resources.

The librarian stores information resources that are relevant for the library user in a resource object. For example, if an Internet search engine returns one or more relevant URLs these are added to the resource object. Relevant urls, book references etc. are added to the resource object that holds the currently selected resources and notes about these.

During the search process the librarian improves his understanding of the library user's information needs and adjusts the search terms and the parameters in order to obtain more useful search results. When the service has been executed the library user receives the resource object as the result of the service.

The librarian interacts with the search systems in a way that is visible for the library user. The library user can see the queries and the corresponding search results. There is an important element of cognitive activities where the user and the librarian tries to understand the problem at hand and where they consider possibilities and reflect upon formulations and search results.

In the as-is version of the service the resource object is an un-integrated collection of digital text documents, paper notes, and screen dumps. This is a major problem with the as-is service execution. The librarian has to create the resource object by means of cut-and-paste, handwriting, and printing operations. Consequently, the librarian creates the semantic integration of the search systems and the resource object.

The IT systems do not support the integration in any way. Also, the resource object itself is heterogeneous and it is not internally integrated because it is composed of hand-written notes, printed screen-shots, and digital text documents. It is very difficult to reuse past search results and share the information represented by these among librarians and library users. The purpose of the innovation project was to create an IT tool that could support the creation and maintenance of resource objects.

The models in Figure 1 were created in order to represent the as-is version of the service in terms of flow (the left-hand side model) and interaction (the right-hand side model). The notation is informal. In the flow model, rectangles represent objects and round-corner rectangles represent activities. In the interaction model, ovals represent actors and rectangles represent objects.

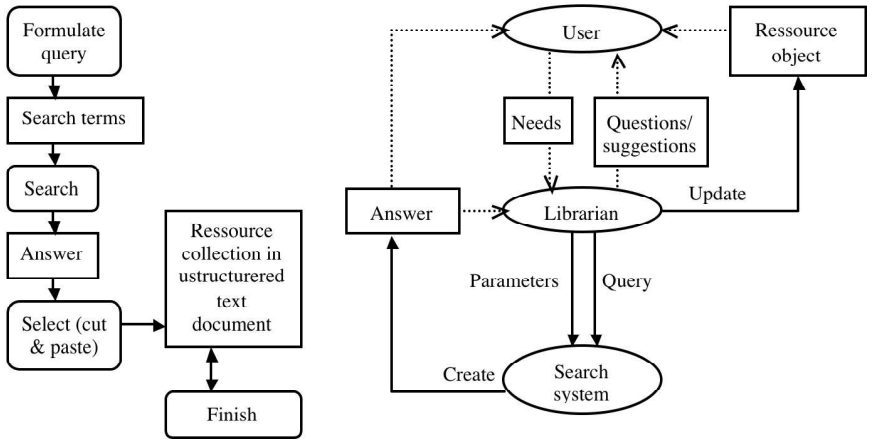

Figure 1 Flow- and interaction-oriented as-is models

The flow-oriented model (the left-hand side model) in Figure 1 can be interpreted as follows. Formulate query is an activity in which the user expresses information needs and the librarian asks questions and suggests interpretations. Search is an activity in which the librarian formulates a set of search terms that is used as input to a search activity in which the librarian uses the search terms to ask a query to a search system. The user and the librarian analyze and evaluate the answer—a set of objects that is returned from the search system (database, Internet search engine, etc.). Select is an activity in which the librarian uses "cut & paste" to copy relevant resources from an answer to the resource collection—a text document in which the selected resources from search answers are stored. Finish is an activity in which the resource collection is formatted and enhanced with clarifying comments.

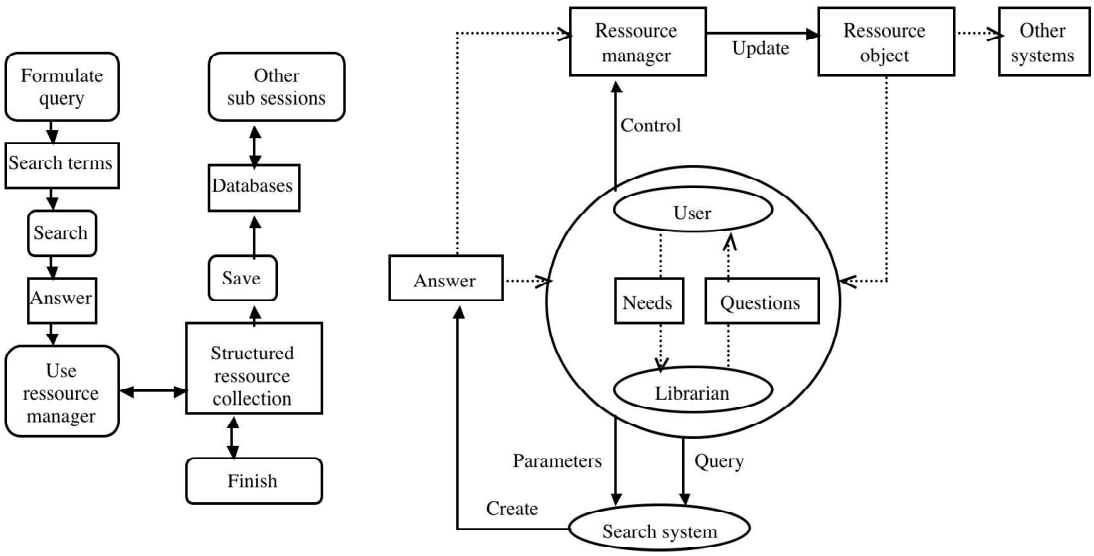

Figure 2 Flow- and interaction-oriented to-be models

The interaction-oriented model (the right-hand side model) in Figure 1 can be interpreted as follows. Two persons, a librarian and a library user, participate in the activities. The library user expresses information needs. The librarian asks

questions and suggests interpretations. The librarian adjusts search system parameters. The librarian poses query with search terms to a search system. The search system creates an answer to a query.

The models in Figure 2 were created in order to represent the envisioned to-be version of the service in terms of flow (the left-hand side model) and interaction (the right-hand side model).

The flow-oriented model (the left-hand side model) in Figure 2 can be interpreted as follows. Formulate query and Search are executed as in the as-is service. The as-is activity "select" has been replaced by the activity "use resource manager" in which the librarian uses an IT tool called a resource manager to transfer relevant information resources directly from their sources (search systems) to a resource object. Finish is an activity in which the librarian adds information to the resource object. Save is an activity in which the librarian saves a resource object to one or more databases form which they can be reused in other information search sessions (Other sub sessions).

The interaction-oriented model (the right-hand side model) in Figure 2 can be interpreted as follows. The major difference between the as-is model and the to-be model is that the librarian can interact with a resource manager that transfer selected parts of a search system answer to a fully digitalized resource object. The librarian controls the resource manager and the resource object is maintained as an integrated object that contains all currently selected information resources. Rather than manually updating an unstructured resource collection then librarian uses the resource manager to select and modify selected resources in a simple and uniform manner. The resource object can be reused by other systems, including future "book a librarian" services. Apart from simplifying the recording of relevant resources the resource manager integrates the otherwise non-integrated search systems.

As illustrated in the previous discussions the as-is service and the to-be service were modeled in two different and complementary ways. The flow-oriented models in Figure 1 and Figure 2 represent the as-is and to-be services in a flow-oriented manner where the temporal sequencing of activities are highlighted. The interaction-oriented models in Figure 1 and Figure 2 was created in order to overcome a set of problems that characterized the flow-oriented models. They represent the as-is and to-be services in an interaction-oriented manner.

The modeling activities revealed that flow-oriented activity models had a set of limitations. It was very difficult to emphasize the differences between the as-is service without the resource manager and the to-be service with the resource manager by means of flow-oriented modeling. The roles of the resource manager and its relations to the library user and the librarian are represented in a very implicit manner in the flow-oriented models.

In the interaction-oriented models the roles of the resource manager are represented explicitly. These models explicitly represent the fact that the resource manager is controlled by humans, that it has access to search system answers, and it is the only mean of controlling the resource object.

Process 4 - Improvement of interaction primitives

After the innovation project was finished we improved the interaction primitives in two ways. We used linguistic theory to analyze and improve the interaction primitives (Bækgaard and Andersen 2008; Bækgaard 2011). Figure 3 illustrates how the improved interaction primitives can be used to model a socio-technical system that represents the execution of the redesigned library service.

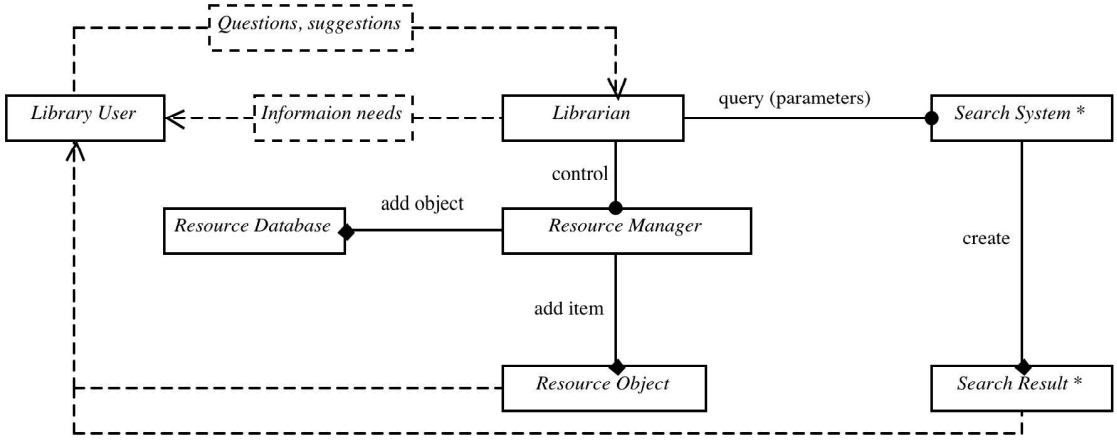

Figure 3 Interaction primitives

The rectangles represent participating elements, i.e., human beings, technology, and information. The lines represent potential interactions. The star means that more than one specific element may play the role.

The librarian can receive (sense) expressed information needs from the library user who in turn can receive (sense) expressed questions and suggested interpretations from the librarian. The librarian formulates a set of search terms that is used as input to a search activity in which the librarian uses the search terms to ask a query to a search system (database, Internet search engine, etc.). The librarian controls the search systems. The library user and the librarian analyze and evaluate search result—a set of objects that is created by the search system. The librarian modifies the resource object by adding relevant resources from a search result to the resource object. The library user can see (sense) the resource object and the search result.

Process 5 - Design of service scenarios

The experiences from the innovation project has led to the design of the notion of service scenarios (Bækgaard 2009). Service scenarios view a service as a socio-technical system and they highlight the interactive acts that are performed when a service is executed. The interaction may be interaction may be communicative interaction between human being, interaction between human beings and IT systems, and interaction between human beings or IT systems and information. Service scenarios represent the major elements that participate in a service execution, i.e., people, technology, information etc.

As shown in Figure 4 a service has a provider that offers the service and a consumer that benefits from the service. The provider and the consumer perform a series of actions when a service is executed. Providers and consumers may share a set of resources. In the library example the resource object and the search results can be viewd as shared resources.

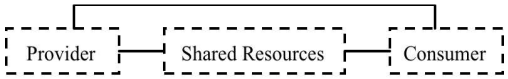

Figure 4 A model of service scenarios

A provider may be a set of persons and/or IT systems that performs the work necessary to execute a service in interaction with a consumer. A provider possesses the right to offer a service and make it available to potential consumers that may be constrained. A consumer uses a service and benefits from its effects. A consumer may be a set of persons and/or IT systems that uses a service in interaction with an executor according to a service-level agreement—a contract between a provider and a consumer.

The provider may interact with the consumer in order to negotiate conditions for access to services. This may include service-level agreements about price, payment, availability etc. The provider hires, builds, buys and organizes executors. If the executor is a person the provider may hire him or her. If the executor is an IT system it may be bought, rented or constructed by the provider.

When a service is executed the executor interacts with the consumer in terms of commands and exchange of resources. The executor and the consumer may interact with the shared resources. The executor may interact with executors of other services relative to which it acts as a consumer. The effect of executing a service is a realization of a set of effects in terms of delivered resources and/or a change to a set of shared resources.

The notion of shared resources emerged as a consequence of the innovation project in the library. Shared resources are resources that are shared between the provider and the consumer. In the library service the librarian and the library user interacts with resources like search systems, search results, notes, and resource objects. Both parties have access to these resources and in the innovation project it was useful to view these resources as resources that was shared by the librarian and the library user.

Modeling techniques like COSMO (Quartel, Steen et al. 2007) can be used to model interaction between service consumers and providers in a manner that resembles service scenarios. However, COSMO do not support modeling of shared resources that are shared by consumers and executors. Furthermore, COSMO do not support modeling of the elements that constitute consumers and executors. In general, service consumers and service executors may be comprised of socio-technical systems with internal interaction that is important for the execution of services. Service scenarios can be used to model consumers and executors as simple or complex socio-technical systems.

Maglio et al. (2006) characterize a service in terms its provider, client, and target. The provider is comprised of an individual or organization and technology operated by or owned thereby. The client is an individual or organization. The target is a part of reality that must be transformed or operated on by the provider for the sake of the client. The target may be comprised of a combination of people, businesses, products, and information. This implies that the effect of a service should be explicitly understood in terms of the changes made to a target that is shared by the provider and the client. The notion of shared resources in service scenarios can be viewed as an extension of Maglio's targets. Shared resources can

represent the resources that are affected by a services (for example the resource manager in the library example) but in addition they can serve as resources that are shared during the execution without being a part of the result of the service (for example the search results in the library example).

ANALYSIS OF RESEARCH PROCESSES

In this section we use a design science perspective to analyze the five design-based research processes that we described in the previous section. Design science is a research approach that emphasizes research where design of an artifact constitutes an essential element of the research. The designed artifacts can be constructs, models, methods, or instantiations (March and Smith 1995).

Hevner et al. use seven guidelines to characterize design science (Hevner, March et al. 2004). 1. Design must be viewed as an artifact. 2. The problem that is partially solved by means of the artifact must be relevant in a specific context. 3. The designed artifact must be evaluated. 4. There must be one or more research contributions. 5. The research must be performed in a rigorous manner. 6. The design must be a search process (the solution must not be obvious). 7. The research results must be communicated.

March and Smith use two dimensions to characterize design science (March and Smith 1995). The first dimension covers the processes. The second dimension covers the type of the designed artifact. The process dinension has five elements: Build, evaluate, use, theorize, and justify. The artifact dimension has four elements: Constructs, models, methods, and instantiations. The basic idea is that an artifact of a specific type must be build, evaluated, used, and justified, and it must be used as the basis of a theorization.

Pfeffers et al. characterize design science in terms of six processes (Peffers, Tunanen et al. 2006). 1. Problem identification. 2. Objectives of solution. 3. Design and development. 4. Demonstration. 5. Evalation. 6. Communication.

These three approaches to design differs in way the frame the notion of design science. They share the characteristic that there must be a design prosses resulting in an artifact and that the design of the artifact and the artifact must be the basis of a research process. Consequently, they all combine a development-oriented view (design of something) with a research-oriented view (produce new knowledge).

In the following table we have used the guidelines from Hevner et al. to analyze the research process that we described in the preceeding section.

	Library service	**Activity cases**	**Interaction primitives**	**Service scenarios**
Design as artifact	The redesigned service is a designed artifact.	Activity cases, interaction primitives, and service scenarios are conceptual artifacts resulting from design processes. Activity cases and interaction primitives were designed before the innovation project. Service scenarios were designed as a result of the innovation project.		
Problem relevance	The relevance of the envisioned service improvement was evalued by means of use sessions before it was implemented.	The innovation project brought strong evidence of the relevance of the problems that can be partially solved by the modeling tools.		
Design evaluation	The redesigned library service were evaluated by means of use experiments during the innivation project.	Activity cases and interaction primitives were evaluated during the innovation project. After the innovation project interaction primitives were evaluated and improved by means of linguistic theory. After the innovation project service scenarios were evaluated by means of comparison to alternative approches.		
Research contributions	The library service itself is not a research contribution but it has served to design improve three modeling	General approach to activity modeling.	General approach to interaction modeling in socio-technical systems.	General approach to modeling of service execution scenarios.

	approaches.			
Research rigor	The redesigned service has not been analyzed by means of formal research methods.	Analaytical and example-based comparison to other approaches.	Analaytical and example-based comparison to other approaches. Linguistic foundation.	Analytical and example-based comparison to other approaches.
Design as a search process	From the outset of the innovation project it was not clear what a good solution would be.	A search for a small but sufficient set of defining attributes of activities. Emerged as a consequence of the breakdown of use cases.	A search for generic patterns for interaction primitives. Emerged as a consequence of a breakdown of flow-oriented modeling techniques.	A search for ways to represent shared resources. Emerged as a consequence of the way resources were shared in the library service and a breakdown of existing tools.
Communication of research	The research results have been published in research papers (Bækgaard 2005), (Bækgaard 2006), (Bækgaard, Jørgensen et al. 2007), (Bækgaard and Andersen 2008), (Bækgaard 2009), (Bækgaard 2011).			

Table 1 Summary of analysis

Table 1 summarizes our analysis of the five design-based research processes from the previous section. The vertical dimension is constituted by the seven design science guidelines (Hevner, March et al. 2004). The horizontal dimension is constituted by the four different artifacts that were created during the research processes: A library service and three modeling techniques (activity cases, interaction primitives, and service scenarios). We used the seven guidelines to analyze each artifact.

DISCUSSION

The purpose of the service innovation project in the library was to redesign a library information service called "book a librarian". Design played several interesting roles in the project during which experiments with two predesigned modeling techniques (activity cases and interaction primitives) were carried out. It became clear that the initial notation used for interaction primitives was cumbersome and undesirable. As a consequence, the notation for interaction primitives were improved after the completion of the project. The fact that the provider and consumer use shared resources during execution of the service "book a librarian" made it clear that existing modeling techniques had weaknesses. The design of a modeling tool called service scenarios emerged as a result of these experiences from the service innovation project.

Service designers can benefit directly from these design results by using the three designed tools. Activity cases can be used to supplement use cases and thereby support a more rich understanding of the activities that are carried out when a service is executed. Interaction primitives can be used to supplement flow-oriented modeling approaches and thereby support a direct modeling of the interactive roles played by human beings and artifacts during service execution. Service scenarios can be used to highlight the importance of resources that are shared among service providers and service consumers.

Table 1 demonstrates by example that a design science perspective can be used to describe and analyze a set of related design-based research processes. The table is based on seven guidelines for design science. The guidelines have been created in order to support research processes that are based on design of prototypes or other artifacts. The examples in the table demonstrates this by emphasizing design as a process that is aimed at providing solutions in a specific context and by emphasizing the need for research methods in order to support production of new knowledge and new insights.

While design science is a relevant framework for researchers the following question arises: Can design science be relevant for designers for whom the designed artifacts represent the primary purpose of design? The examples in Table 1 indicate that this may be the case. The first three guidelines are directly aimed at the practicallly oriented aspects of design. (1) Design must be viewed as an artifact. (2) The problem that is partially solved by means of the artifact must be relevant in a specific context. (3) The designed artifact must be evaluated. These guidelines are inherently relevant for designers.

The remaining four guidelines are mostly aimed at researchers whose purpose is to contribute to the existing body of research knowledge. We can, however, reformulate the remaining four guidelines in the following manner that brings attention to the notion of learning. (4) There must be a focus on learning from the design process. 5. The learning must

must be performed in a systematic manner. 6. If possible, there must be a focus on non-trivial design processes. 7. The learned insights must be communicated.

These variants of the four last guidelines combine a practically oriented designer's focus on design with a supplementary focus on learning. Researchers view design as a method for knowledge production whereas designers view design as a process with its own inherent purpose. By changing the guidelines' current focus on research to a more broad focus on learning we are able to expand design science to a framework that may be as relevant for practitioners as for researchers.

CONCLUSION

We have demonstrated the usefulness of design science as an analytical tool for understanding related design-based research processes. We have use a design science perspective to create a coherent description of five related design-based research processes. The use of a design science perspective to describe and understand a complex design-based research process is summarized in Table 1 that illustrates how a design science perspective can be used to describe and understand complex design-based research processes and the relations between such processes.

Future work will be based on the question: Can Table 1 be used as the basis of a tool for describing and analyzing design processes? In its current version the time dimension is implicit. Consequently, it is somewhat difficult to get an overview of the time dependencies between the elements of the table. Therefore, it could represent a significant improvement if an explicit time dimension could be added. Also, in our future work we will include other perspectives on design science and compare these to the approach that is based on seven guidelines.

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REFERENCES

1. Bækgaard, L. (2005). From Use Cases to Activity Cases. Conference on Action in Language, Action in Language, Organisations and Information Systems (ALOIS'05). Limerick, Ireland.
2. Bækgaard, L. (2006). Interaction in Information Systems - Beyond Human Computer Interaction. Conference on Action in Language, Action in Language, Organisations and Information Systems (ALOIS'06). Borås, Sweden.
3. Bækgaard, L. (2009). Service scenarios - a socio-technical approach to business service modeling. ECIS'2009 - European Conference of Information Systems 2009. Verona, Italy.
4. Bækgaard, L. (2011). A Socio-Technical Approach to Interaction Modeling. Americas Conference on Information Systems - AMCIS'08. Detroit, USA.
5. Bækgaard, L. and P. B. Andersen (2008). Using interaction scenarios to model information systems, Aarhus School of Business, Denmark.
6. Bækgaard, L., J. B. Jørgensen, et al. (2007). On Industrial Use of Requirements Engineering Techniques. 2nd International Workshop on Enterprise Modelling and Information Systems Architectures (EMISA'07). St. Goar, Germany.
7. Cockburn, A. (2001). Writing Effective Use Cases, Addison-Wesley.
8. Hevner, A. R., S. T. March, et al. (2004). "Design Science in Information Systems Research." MIS Quarterly 28(1): 75-105.
9. Hill, T. P. (1977). "On Goods and Services." The Review of Income and Wealth 23(4): 315-338.
10. Maglio, P. P. and J. Spohrer (2008). "Fundamentals of Service Science." Journal of the Academy of Marketing Science 36: 18-20.
11. March, A. T. and G. F. Smith (1995). "Design and Natural Science Research on Information Technology." Decision Support Systems 15: 251-266.
12. Peffers, K., T. Tunanen, et al. (2006). The Design Science Research Process: A Model for Producing and Presenting Information Systems Research. Design Science Research in Information Systems and Technology. Claremont, California, USA.
13. Quartel, D. A. C., M. W. A. Steen, et al. (2007). "COSMO: A Conceptual Framework for Service Modelling and Refinement." Information System Frontiers 9: 225-244.
14. Sampson, S. E. and C. M. Froehle (2006). "Foundations and Implications of a Proposed Unified Services Theory." Production and Operations Management 15(2): 329-343.
15. Sheth, A., K. Verna, et al. (2006). "Semantics to Energize the Full Services Spectrum." Communications of the ACM 49(7): 55-61.